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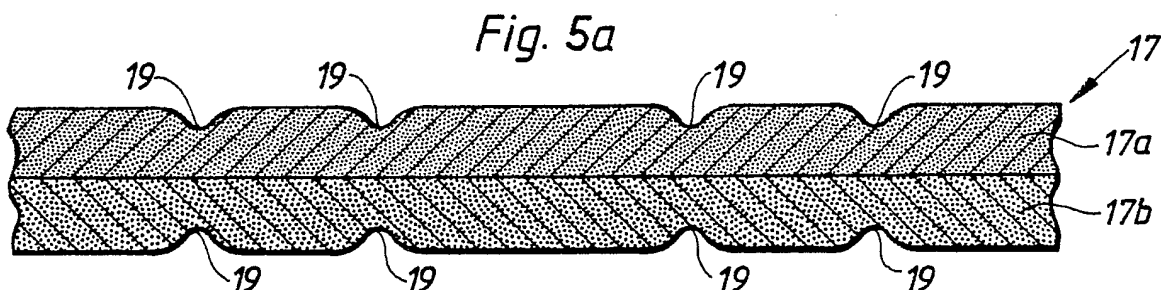
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54 A flexible packing material in sheet or web form.

57 Flexible, creased material in sheet or web form for the manufacture of liquid-tight packing containers of good dimensional rigidity, which material comprises one or more base layers laminated to one another of a mineral-filled thermoplastics comprising between 50 and 80% calculated on the total weight of the mixture , of an inorganic, particulate mineral filler. Said thermoplastics is chosen among propylene-based polymers with a melt index of between 0,5 and 5 according to ASTM (2,16kg, 230 ° C) and said base layer or base layers are provided with a pattern of crease lines which have been formed by plastic deformation in connection with or immediately after the extrusion of said base layer or base layers.

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A FLEXIBLE PACKING MATERIAL IN SHEET OR WEB FORM

This invention relates to a flexible, creased material in sheet or web form for conversion to liquid-tight packing containers of good dimensional stability. Said material comprises one or more extruded base layers laminated to one another of mineral-filled thermoplastics comprising between 50 and 80%, calculated on the total weight of the mixture, of an inorganic, particulate mineral filler.

In packing technology packages of non-returnable character have been used for a long time which are manufactured from a material comprising a base layer of paper or cardboard with outer and inner coatings of thermoplastics. The material in these so called non-returnable packages is often also provided with further layers of other material, e.g. Al-foil or plastic coatings other than those mentioned here.

The composition of the packing material sets out from wish to create the best possible protection for the product which is to be packed, at the same time as a package is to be given the required mechanical strength and durability to enable it to withstand such outer external stresses as the package is subjected to in normal handling. To achieve mechanical rigidity, which on the one hand gives mechanical protection to the product and on the other hand makes it possible for the package to be dimensionally so rigid as to allow it to be handled and manually gripped without difficulty, the material in these packages is frequently provided with a relatively thick base layer of paper or cardboard. Such a material, however, possesses no tightness properties towards liquids or gases, and the rigidity of the material aimed at is quickly lost when it is subjected to moisture. To impart the required liquid-tightness to the material the base layer is provided therefor, frequently on both sides, with a coating of plastic material, and if this plastics is thermoplastics the coating may also be used for sealing the plastic coatings to one another by so-called heat-sealing. In this manner packages can be sealed and made lastingly permanent in their intended shape by heat-sealing together thermoplastic-coated, overlapping material panels in liquid-tight and mechanically durable sealing joints.

Non-returnable packages of the type referred to here are manufactured in most cases with the help of packing machines which either from a web or from prefabricated blanks of a packing material form, film and seal finished packages at a high rate of production. Packages are manufactured, e.g. from a web by joining together the longitudinal edges of the web in an overlap joint so as to form a tube which is subsequently filled with the actual

contents, and through repeated flattening and sealing of the tube, at right angles to the longitudinal axis of tube, is divided to closed packages. The packaging units finally are severed from one another by means of cuts in the transverse sealing zones and are given the desired geometrical shape, usually a parallelepiped, by a further folding and sealing.

During the manufacture of packages in the manner described above the laminated material is subjected to stresses which become particularly great on folding of the material, since owing to the relatively great material thickness of the base layer, a folding implies that the one plastic coating is subjected to a strong stretching at the same time as the other plastic coating is compressed to a corresponding degree along the folding line. Thanks to the great extensibility of the plastic coatings such material folding only rarely leads to breaks or other damages causing leakage in the plastic coating extended by stretching, but the problem is aggravated if the material also comprises an Al-foil which compared with the plastic coatings has a much smaller extensibility and consequently tends to crack when the material is folded.

Even if a single 180° folding of the material normally does not have any serious consequences, considerable difficulties arise when the material is to be folded along two crossing crease lines. This is often the case in external sealing areas always occurring on this type of packages, irrespectively of whether they are manufactured from a web or from prefabricated blanks. The sealings generally are carried out in that the plastic coating facing towards the inside of the package is heated to melting along the edge zones which are to be sealed to one another, whereafter the heated plastic coatings are pressed against one another to form a sealing fin held together through surface fusion on the outside of the package. Such a fin comprises double material layers, and to ensure that it does not form an obstacle, the fin frequently is folded down to lie flat against the outside of the package, which means that one of the material layers of the sealing fin undergoes a 180° folding over, and that the package wall in the region of the folded-down fin comprises three material layers, that is to say, has a threefold material thickness. Such a sealing fin often runs along one or more side faces of the package, and since these side faces in the forming of, for example, parallel-pipedic packages are subjected to a 180° folding along a crease line at right angles to the sealing fin, the material thickness in certain regions of the

package will go up to six times the laminate thickness. At this 180° folding transversely to the sealing region the material layers located outermost will be subjected to very strong tensile stresses with accompanying extensions and increased risks of crack formation in the material. These tensile stresses frequently are so great that cracks occur not only in the Al-foil included in the material, but also in the thermoplastic coatings with accompanying risk of leakage of the packed contents which can readily be absorbed by, and impair the rigidity of, the base layer of the material.

Since conventional packing material based on paper or cardboard obviously is associated with serious disadvantages related essentially to a fibrous layer being used in the materials which of necessity has to be relatively thick in order to impart mechanical rigidity to the material, it has been an aim for a long time to find new packing material, wholly freed of fibrous material for the manufacture of liquid-tight packing containers with good dimensional rigidity. It is an object of the present invention thus to provide directions concerning such packing material free of paper or cardboard.

It is a further object of the invention to provide a packing material which with the help of modern, high-capacity packing machines can be converted readily to liquid-tight, dimensionally rigid packing containers without the risk of crack formations when the material is folded during the manufacture of the containers.

These, along with further, objects are achieved in accordance with the present invention in that a flexible packing material in sheet or web form has been given the characteristics specified in the subsequent claim 1.

Preferred embodiments of the packing material in accordance with the invention have been given, moreover, the characteristics specified in the subsequent subsidiary claims.

The invention will be described in the following in more detail with special reference to the attached drawings, wherein

Figure 1 shows a part of a packing material in web form in accordance with one embodiment of present invention,

Figure 2 shows a strongly enlarged cross-section of the material in Figure 1 along the line II-II,

Figure 3 shows schematically an arrangement for the manufacture of the packing material,

Figure 4 shows a part, corresponding to a whole package length, of a packing material in web form in accordance with a second embodiment of the present invention,

Figure 5a is a strongly enlarged cross-section of the material in Figure 4 along the line V-V,

Figure 5b is a cross section corresponding to that in Figure 5a of a packing material in accordance with a further embodiment of the present invention, and

Figure 6 shows schematically an arrangement for the manufacture of the packing material in Figure 4 and 5a.

Figure 1 thus shows a part corresponding to a whole package length L of a material in web form according to the invention which has been given the general reference designation 1. From the web 1 are manufactured packing containers, as pointed out earlier, in that both longitudinal edge zones 2 of the web 1 are joined to one another in an overlap joint so as to form a tube which subsequently is filled with the actual contents. The filled tube is divided thereafter into individual container units by means of repeated flattening and sealing of the tube along narrow transverse sealing zones 3 at right angles to the longitudinal axis of the tube. Finally the container units are separated from one another by cuts in the transverse sealing zones 3 and are given the desired shape, e.g. parallelepipedic, through a further forming and sealing operation.

The material in accordance with this embodiment of the present invention, as is evident from Figure 2, comprises a base layer 4 of mineral-filled propylene-based polymer with a melt index of between 0,5 and 5 according to ASTM (2,16kg, 230° C). The quantity of filler in the polymer may vary between 50 and 80% of the total weight of the mixture, but preferably is within 65-75% by weight, which has been found to produce optimum properties of the material with regard to rigidity and modulus of elasticity.

Said propylene-based polymer may be a polypropylene homopolymer with a melt index of below 1 according to ASTM (2,16kg, 230°), but preferably the propylene-based polymer is chosen along propylene-ethylene copolymers with a melt index within the above specified range of between 0,5 and 5 since they have turned out to withstand folding and bending operations without cracking even at low temperatures which normally occur during the conversion of the packing material into and filling of the fold packing containers with liquid food, such as milk.

The choice of filler is not critical in accordance with the invention, but, practically speaking, the whole of the arranged known mineral fillers may be used, e.g. mica, talc, calcium salts such as calcium sulphate or calcium carbonate etc. A base layer containing 65% by weight of calcium carbonate in particle form with a grain size of under 10 µm, however, has been found to be the material combination functioning well in practice which makes possible the manufacture of liquid-tight packing

containers with the desired good dimensional rigidity. The material thickness d of the base layer may very inpractice between 100 and 400 μm , but preferably amounts to 300 μm .

To facilitate the conversion of the web 1 to packing containers the base layer 4 has been provided with an arbitrary pattern of crease lines 5 and 6 facilitating the folding, which respectively extend parallel and transversely to the longitudinal direction of the web. In the example shown the crease lines 5 and 6 have been formed by plastic deformation of the base layer 4 in connection with or immediately after extrusion of said layer.

The material in web form 1 described above can be manufactured with the help of an arrangement of the type shown schematically, in Figure 3. The arrangement comprises an extruder 7 with a suitably dimensioned nozzle 8 and two feed-funnels 9 and 10 for the charging of the starting material necessary for the extrusion, that is to say granulated propylene-based polymer with a melt index of between 0,5 and 5 according to ASTM (2,16kg, 230°), such as a polypropylene homopolymer or a propylene-ethylene copolymer, and mineral filler respectively. The thermoplastic mass containing between 50 and 80, e.g. 65% by weight of filler is heated to softening or incipient melting (approx. 180-300° C), and is extruded through the nozzle 8 to form a 100-400 μm , e.g. 300 μm , film 1'. The film 1' is passed through the nip between co-operating, cooled pressure cylinders 11 and 12, one cylinder 11 of which being provided on its outer surface with a pattern formed by raised surface or matrices which are being pressed against the film 1' passing through deposit a complementary surface pattern on one side of the film formed through plastic deformation to produce the said crease lines 5 and 6. The coold film 1 provided with crease lines subsequently can be rolled up on a magazine roll 13.

Figure 4 and Figure 5a show a part corresponding to a whole package length L of a packing material in web form in accordance with a second embodiment of the present invention which has been given the general reference designation 14. From the material web 14 are manufactured filled, liquid-tight packing containers, as described previously, in that longitudinal edge zones 15 of the web 14 are joined to one another in an overlap joint so as to form a tube which subsequently is filled with the intended contents. The filled tube is separated thereafter into sealed container units by means of repeated flattening and sealing of the tube along transverse sealing zones 16 at right angles to the longitudinal axis of tube. Thereafter the container units are given the desired geometrical endform, e.g. parallelepipedic, by a further folding sealing operation.

As is evident from Figure 5a the material according to this embodiment comprises a base 17 consisting of base layers 17a and 17b laminated to one another which are manufactured by means of extrusion of a mixture containing a mineral-filled propylene-based polymer with a melt index of between 0,5 and 5 according to ASTM (2,16kg, 230° C) and between 50 and 80, preferably 65-70%, calculated on the total weight of the mixture, of a particulate, inorganic mineral filler. The propylene-based polymer with a melt index within the above specified range may be a propylene homopolymer with a melt index of below 1 according to ASTM (2,16kg, 23° C), but for reasons described earlier is preferably a propylene-ethylene copolymer.

The filler used in the propylene-based polymer of the base layers 17a and 17b may be mica, talc, calcium salts such as calcium sulphate or calcium carbonate etc. In the example shown it is assumed, however, that one base layer 17a, that is the one facing towards the inside of the intended packing container, contains mica, whereas the other base layer 17b contains calcium carbonate in particle form with a grain size of under 10 μm . The thickness of the respective base layers 17a and 17b included in the base 17 may vary between 50-200, but out of practice considerations the thickness of the respective base layers is preferably 100 μm .

Figure 5b shows a cross section corresponding to that in Figure 5a of a packing material in accordance with a further embodiment of the invention. According to this further embodiment the material comprises a base 18 with outer base layers 18a and 18b of the same material as the base layers 17a and 17b described above with reference to Figure 5a, which are joined to one another by an intermediate layer 18c of a foamed or density-reduced propylene-based polymer with a melt index of between 0,5 and 5 according to ASTM (2,16kg, 230° C).

The total material thickness of the base 18 may vary, but out of practical considerations amounts to approximately 300 μm , all the layers included in the base 18 preferably having the same mutual layer thickness, that is to say 100 μm .

To facilitate the folding of the web 14 in the manufacture of packing containers in the manner described above, the web 14, as is evident from Figure 4, has been provided with an arbitrary pattern of longitudinal and transverse crease lines 19 and 20 respectively. These crease lines (only the longitudinal crease lines 19 whereof are shown in Figure 5a) have been formed by a plastic deformation of the one side or as in the example shown, of both sides of the base 17. In the same manner corresponding crease lines, which for the sake of greater clarity have been given the same reference

designations as in Figure 5a, have been formed in the base 18 shown in Figure 5b.

Figure 6 shows schematically an arrangement for the manufacture of the web 14 in accordance with the invention shown in Figure 4 and Figure 5a. The arrangement comprises a coextruder of a type known in itself with a suitably dimensioned nozzle 23 comprising two slot-shaped openings through which respective base layers 17a and 17b included in the material are coextruded from starting material necessary for the respective layers. The web 14 laminated from the co-extruded base layers is passed whilst continuing to be soft through the nip between two co-operating, cooled pressure cylinders 21 and 22 which on their surfaces are provided with raised portions or matrices of a design which is such that on being pressed against the web 14 passing through they produce a pattern of crease lines facilitating folding formed on both sides of the web by plastic deformation. The cooled web 14 provided with crease lines subsequently can be rolled up on a magazine roll not shown. In a corresponding manner the weblike packing material in accordance with the further embodiment shown in Figure 5b likewise can be manufactured, the extruder in this case, though comprising a nozzle with three slot-shaped openings so as to make possible a co-extrusion of the three layers 18a-18c included in the base 18.

Claims

1. Flexible, creased material in sheet or web form for the manufacture of liquid-tight packing containers of good dimensional rigidity, which material comprises one or more extruded base layers (4; 17a and 17b; 18a, 18b) laminated to one another of mineral-filled thermoplastics comprising between 50 and 80%, calculated on the total weight of the mixture, of an inorganic, particulate mineral filler, **characterized in that** said thermoplastics is chosen among propylene-based polymers with a melt index of between 0,5 and 5 according to ASTM (2,16kg, 230 °C) and in that said one base layer (4) or said base layers (17a, 17b; 18a, 18b) is provided with a pattern of crease lines (5, 6; 19, 20) formed by plastic deformation in connection with or immediately after the extrusion of the respective base layers.

2. Material in accordance with claim 1, **characterized in that** it comprises two base layers (17a, 17b; 18a, 18b) laminated to one another, one of which, preferably that facing toward the inside of the intended packing container, contains mica, whereas the other base layer contains a calcium salt, preferably calcium sulphate or calcium carbonate.

3. Material in accordance with claim 2, **characterized in that** said two base layers are co-extruded.

4. Material in accordance with claim 1 or 2, **characterized in that** each of said two base layers have a material thickness of between 50 and 200, preferably 100µm.

5. Material in accordance with claim 1, **characterized in that** said one base layer (4) has a thickness of between 100 and 400, preferably 300 µm.

6. Material in accordance with any of claims 2-4, **characterized in that** said two base layers (18a, 18b) are joined to one another by means of an intermediate layer (18c) of foamed propylene-based polymer with a melt index of between 0,5 and 5 according to ASTM (2,16kg, 230 °C).

7. Material in accordance with claim 6, **characterized in that** said two base layers (18a, 18b) and intermediate layer (18c) are manufactured by co-extrusion.

8. Material in accordance with claim 6 and 7, **characterized in that** each of said two base layers and intermediate layer have a material thickness of 100 µm.

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Fig. 1

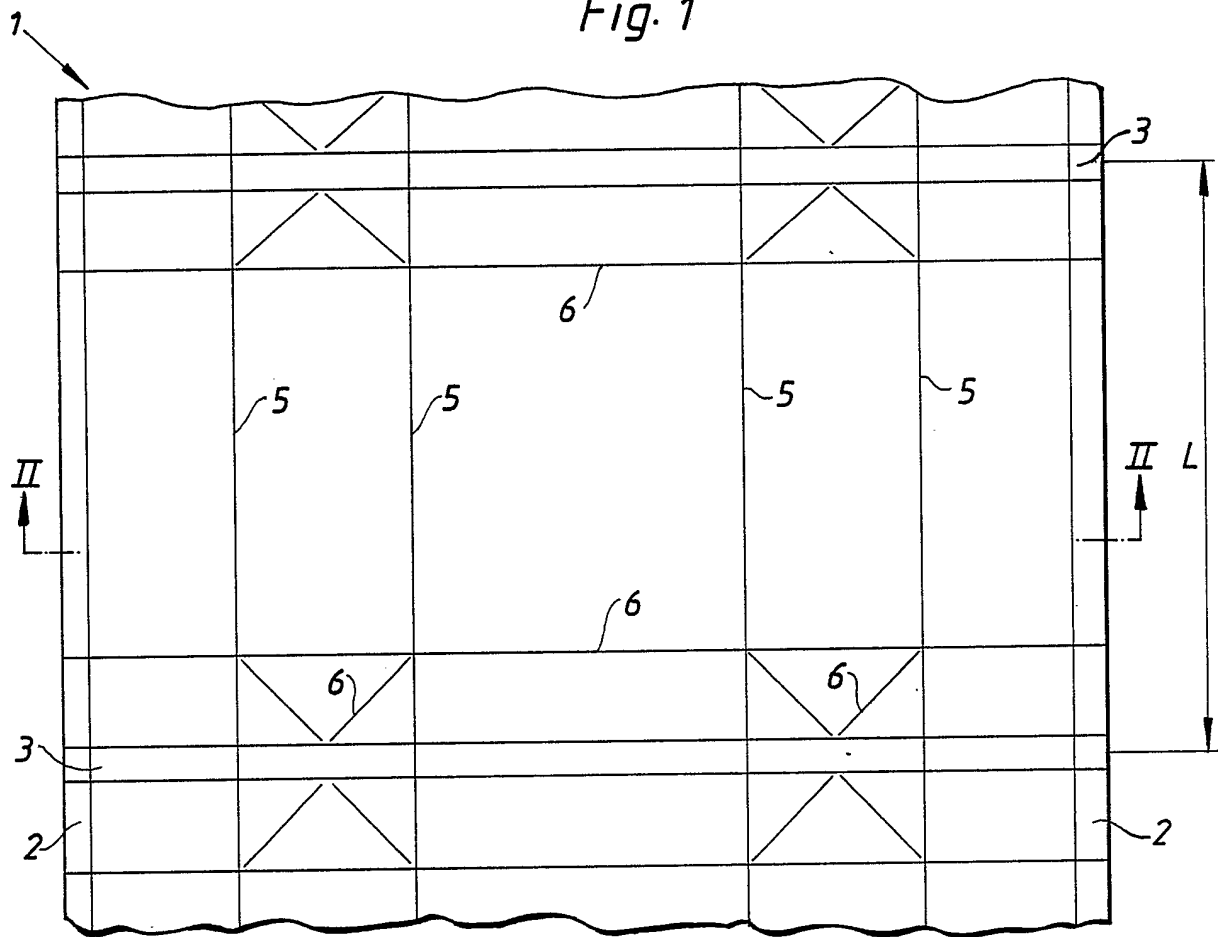


Fig. 2

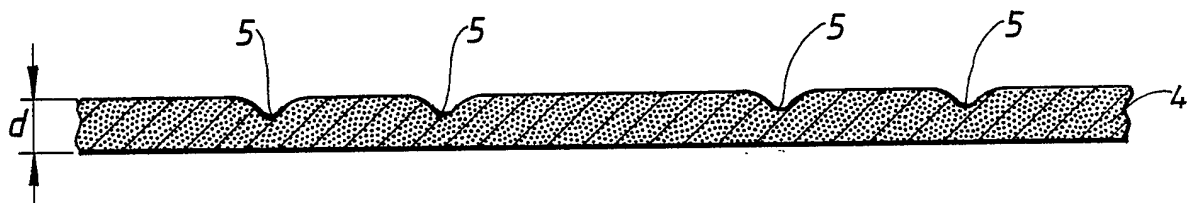


Fig. 3

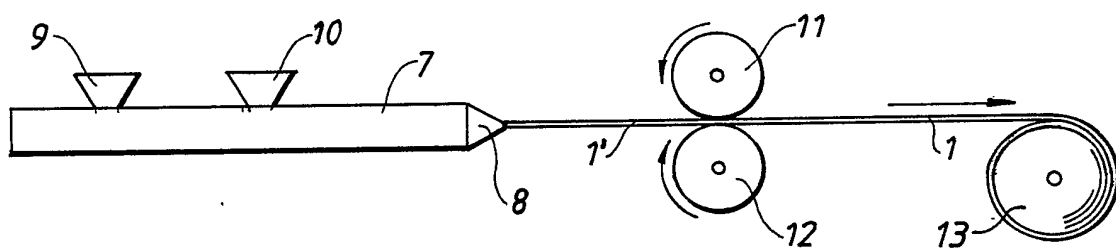


Fig. 4

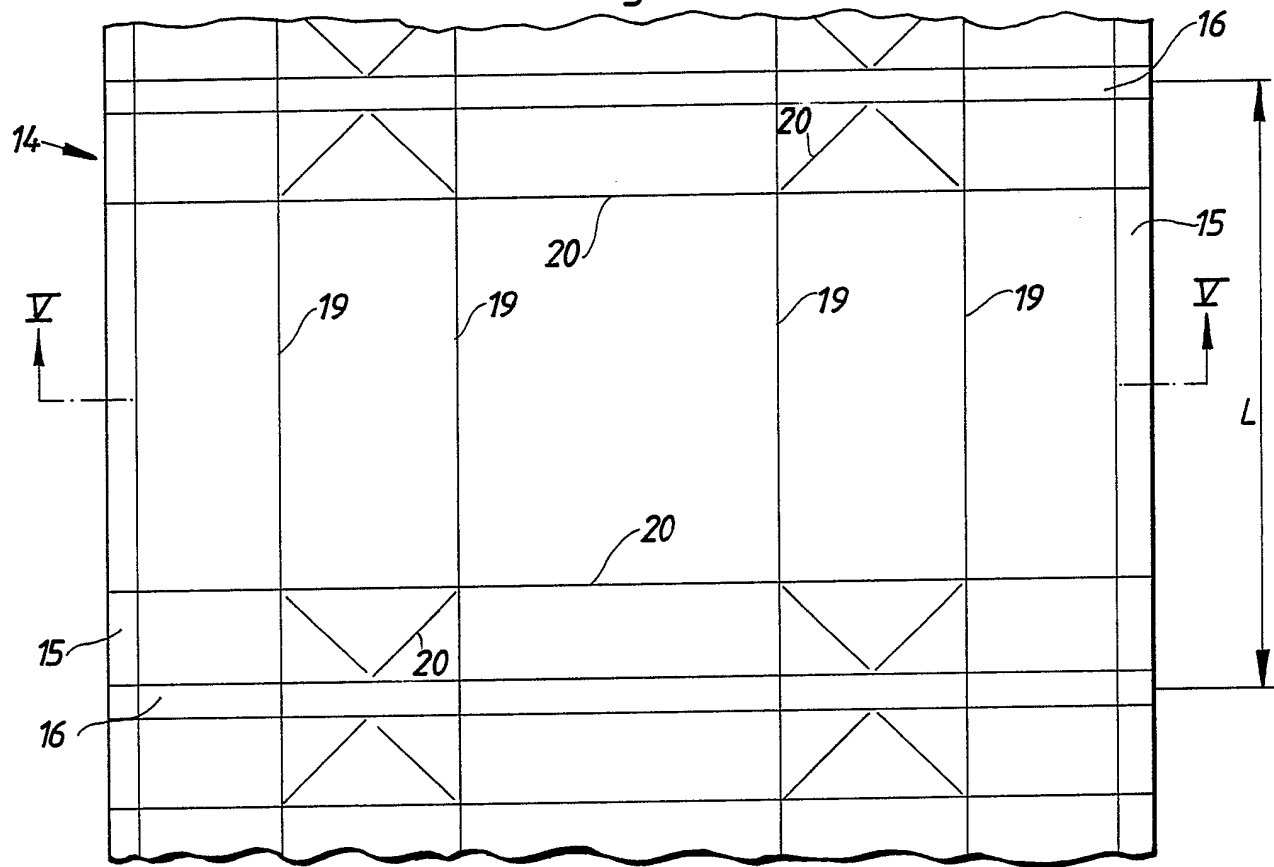


Fig. 5a

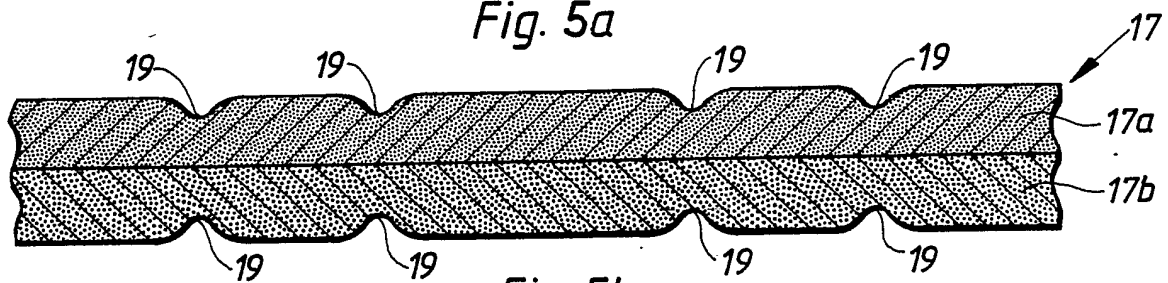


Fig. 5b

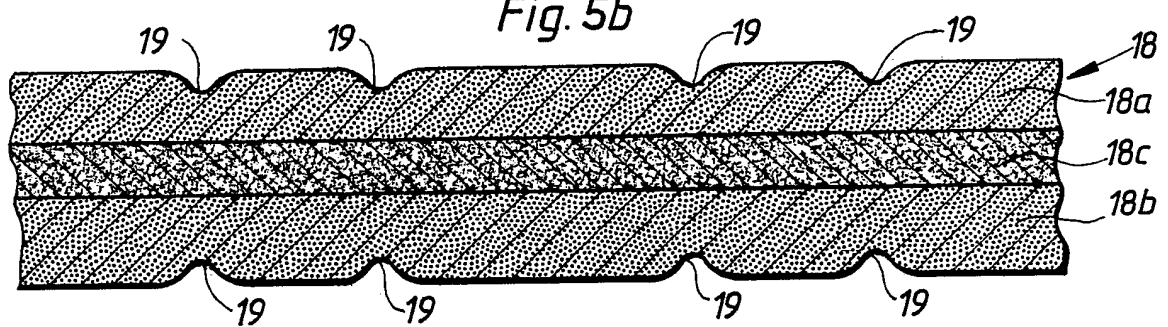
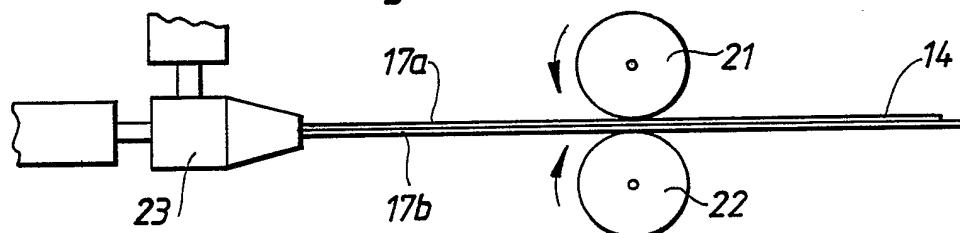


Fig. 6





DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
Y	EP-A-0 084 922 (AMERICAN CAN COMPANY) *Page 4, line 15 - page 5, line 9; page 10, line 4-7; page 11, line 8-14; figure 3; examples*	1-8	B 32 B 27/20 C 08 J 5/18 B 65 D 65/40
Y	GB-A-1 554 143 (PLASTONA LIMITED) *Page 3, lines 115,117; page 4, line 49; page 5, lines 2-10; claim 1, figures 1 and 2*	1-8	
Y	EP-A-0 146 503 (A. VIAL) *Abstract; figure 1*	6-8	
Y	Derwant's abstract No 84-021180/04, JP-58213037	3	TECHNICAL FIELDS SEARCHED (Int. Cl.4)
A	EP-A-0 161 035 (SHELL INTERNATIONALE RESEARCH MAATSCHAPPIJ B.V.) *Page 2, lines 23-32*	1	B 32 B B 65 D C 08 J
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
STOCKHOLM		27-10-1989	SVENSSON E.
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			